

What is claimed is:

1. A distribution manifold for distributing gas and/or liquid phase substance from an inlet to multiple outlets with reduced variations in distribution comprising:
  - a. a body;
  - 5 b. an inlet to the body;
  - c. a plurality of outlets from the body;
  - d. a member comprising a rotatable fluid pathway including an entry end in fluid communication with the inlet of the body and an exit end in fluid communication with the plurality of outlets of the body;
  - 10 e. a distribution void in fluid communication between the exit end of the fluid pathway and the plurality of outlets;
  - f. so that the substance passes through and out the exit end of the fluid pathway and is distributed to the plurality of outlets through the distribution void.
- 15 2. The manifold of claim 1 wherein the substance comprises a fertilizer.
3. The manifold of claim 2 wherein the fertilizer comprises anhydrous ammonia.
4. The manifold of claim 1 wherein the member comprises a rotatable impeller which
  - 20 includes an intermediate portion which includes the fluid pathway, which is defined at least in part by surfaces of the impeller.
5. The manifold of claim 4 wherein the surfaces on the intermediate portion comprise a wall of an external supply groove having the entry end in fluid communication with the
  - 25 inlet of the body and the exit end in fluid communication with the plurality of outlets of the body.
6. The manifold of claim 5 wherein the distribution void comprises an annular distribution groove between the exit of the supply groove and the plurality of outlets.

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7. The manifold of claim 4 wherein the impeller comprises a generally conical member having a tip end and a base end.

8. The manifold of claim 7 wherein the body includes a void between the inlet and plurality of outlets, the void having a conical portion generally matching the shape of the impeller.

9. The manifold of claim 8 wherein the body further comprises a cover removable over the void.

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10. The manifold of claim 9 further comprising a sealing member between the cover and body.

11. The manifold of claim 9 wherein there is some longitudinal tolerance between the impeller and the body when the impeller is operatively positioned in the body.

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12. The manifold of claim 5 wherein the cross-sectional area of the supply groove is generally equal to the cross sectional area of the inlet of the body.

13. The manifold of claim 5 wherein the cross sectional area of the inlet of the body is generally equal to the sum of cross-sectional areas of the plurality of outlets of the body.

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14. The manifold of claim 6 comprising a generally constant cross sectional area along the supply groove, distribution groove, inlet, and the sum of outlets.

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15. The manifold of claim 5 wherein the angle of the wall of the supply groove is generally selected to produce one-half of the pressure of the substance to push longitudinally or forward and one-half of the pressure to push sideways on the impeller.

16. The manifold of claim 1 wherein the fluid pathway comprises a spiral groove approximately three rotations on the impeller.

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17. The manifold of claim 1 wherein the fluid pathway comprises a plurality of spiral grooves each having entrances in fluid communication with the inlet to the body and exits in fluid communication with the distribution void.
- 5 18. The manifold of claim 1 further comprising a bearing associated with the impeller to facilitate rotation of the impeller in the body in response to fluid pressure on the impeller.
19. The manifold of claim 18 wherein the bearing comprises an axle having a bearing  
10 surface at a distal end extended inwardly of the body.
20. The manifold of claim 1 wherein the plurality of outlets are radially disposed and spaced apart around a body.
- 15 21. The manifold of claim 20 further comprising a connector mounted in fluid communication with each of the plurality of openings in the body, the connectors adapted for connection to fluid conduits.
22. The manifold of claim 21 wherein the connectors are adapted for connection to  
20 fluid conduits terminating in injection knives.
23. The manifold of claim 1 wherein the inlet of the body includes a connector adapted for connection to a source of the substance.
- 25 24. The manifold of claim 23 wherein the connector is in fluid communication with a tank of substance.
25. The manifold of claim 1 further comprising an actuator operatively connected to the  
30 impeller to rotate the impeller in the body.
26. The manifold of claim 25 wherein the actuator is a motor.

27. The manifold of claim 1 further comprising a sensor operatively positioned to derive speed of rotation of the impeller.

5 28. The manifold of claim 1 in combination with an implement to carry a plurality of injection knives.

29. The manifold of claim 28 further in combination with an automotive vehicle.

10 30. The manifold of claim 29 further in combination with a tank of anhydrous ammonia.

31. A method of distributing a gas and/or liquid phase substance from an inlet to multiple outlets comprising:

15 distributing substance to the plurality of outlets by rotating a fluid pathway in fluid communication between inlet and a space in fluid communication with all of the plurality of outlets.

20 32. The method of claim 31 further comprising a rotatable impeller defining the fluid pathway sealed in a chamber between inlet and outlets.

33. The method of claim 32 wherein the impeller is freely rotatable in the chamber.

25 34. The method of claim 32 wherein the fluid pathway comprises one or more external grooves each having an entry at the inlet and an exit.

35. The method of claim 31 wherein a wall of the fluid pathway is angled relative to the direction of flow of substance from the outlet in generally a spiral groove.

36. The method of claim 35 wherein the angled surface is designed so that approximately one-half the pressure of the substance is directed longitudinally or forwardly and one-half the pressure is approximately sideways relative the impeller.

5 37. The method of claim 31 further comprising minimizing expansion areas along the fluid path of the substance.

38. The method of claim 31 wherein the cross sectional area of the fluid path of the substance is relatively consistent from inlet to outlets.

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39. The method of claim 31 further comprising rotating the impeller by force other than or in addition to pressure from the substance against the impeller.

40. The method of claim 31 further comprising sensing the rate of rotation of the  
15 impeller.

41. The method of claim 31 further comprising operatively connecting the outlet with a source of the substance, and the outlets with an application system, and a moving the system with an automotive vehicle means.

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42. The method of claim 31 wherein the substance comprises anhydrous ammonia.

43. An apparatus for distributing a gas and/or liquid phase substance from an inlet to multiple outlets comprising:

25 a housing comprising an inlet, a plurality of outlets, a chamber between inlet and a plurality of outlets;

a rotatable member positioned in the chamber, the rotatable member defining an external substance path in fluid communication with the inlet and a space in fluid communication with a plurality of outlets;

30 so that rotation of the rotatable member rotates the substance path and distributes substance from the inlet to the space in fluid communication with the outlets.

44. The apparatus of claim 43 wherein the rotatable member is a conical piece including at least one spiral groove from an entry at or near its tip to an exit at or near the base, and a bearing to facilitate rotation of the conical piece in the housing.